alphabetical order of all the known American tribes and their languages. Each volume has a good useful index, a most important item in a work of this nature.

The abundant equipment of maps adds greatly to the value of the volumes, as the numerous illustrations do to their interest.

OUR BOOK SHELF

Geometry in Modern Life, being the Substance of Two Lectures on Useful Geometry, given before the Literary Society at Eton. By J. Scott Russell, F.R.S. (Eton: Williams and Son, 1878.)

IN a recent number (NATURE, vol. xviii. p. 263) we took occasion to suggest that the usefulness of a school scientific society might still further be increased by calling in the assistance of scientific men to deliver lectures which should be open not merely to the members, but also to a wider circle. The literary Society at Eton has, we believe, adopted this plan on very many occasions; recently it will be remembered that Mr. Gladstone addressed the society on Homer. Mr. Russell's lecture is a full one, and on the lines which it follows, a useful one. "Geometry is a pure science, gives logical training, is a discipline of thought, is an instrument of human culture, and has high educational value. But geometry is equally the development of a method pervading nature; its mastery gives man a power to govern matter. The training which enables him to comprehend the mechanism of the universe, enables him also to make creations of his own in harmony with those greater designs of which his own are but a small portion. These two uses of geometric education the one purely gymnastic, the other practical and technic, may be so combined that each shall aid and not impede the other. The order, number, and measure which pervade the universe can be easily brought within the scope of elementary education, and so form the fit preparation for scientific observation and experiment in later life, by means of which the standard of application of abstract truths to matter and events in human life are determined and made familiar. But the one learning cannot be too soon begun, nor the other too long continued, and each is a material aid to the other." This extract shows the author's views, which he has worked out in some detail. Starting from the Greek geometry, he passes on to useful geometry: its applications to land-measuring, trigonometry, navigation. He touches also on numbers, goes on to symmetry, harmony, melody, then to light, shape, and shadow. He closes with a chapter on matter, force, and motion. To sum up, the whole furnishes a quantity of illustration from an eminent practical man, which is likely to be profitable to teachers in search of such illustration—to allure the "what's the use of it?" boys who form a part of every mathematical master's geometrical classes.

Die Geologie der Gegenwart. Dargestellt und beleuchtet von Bernhard von Cotta. Fünfte umgearbeitete Auflage. (Leipzic: J. J. Weber, 1878.)

THE appearance of a fifth edition of von Cotta's well-known work is a sufficient proof of its popularity—a popularity which, in spite of some unfortunate drawbacks to its usefulness, we cannot but regard as being well deserved. Since the first appearance of the volume in 1866 it has been steadily growing in bulk, and in the present edition the author has brought his work up to date by noticing the principal contributions which have recently been made to geological science. Among such additions we may point to his notices of the method of study of rocks by the means of the microscope, of the new classification and nomenclature of the stratified rocks suggested by Carl Mayer, of the results of the *Challenger* expedition, of the latest speculations on the causes of volcanic activity and the nature of meteorites, and of Croll's theory of the recurrence of glacial periods. The coloured frontispiece now added to the work, we can scarcely regard as an improvement, seeing that it tends to perpetuate those views of the restriction of certain classes of volcanic products to distinct geological periods, which, though so frequently insisted upon by German petrographers, do not appear to be sustained by extended observation in the field.

Ocean and Her Rulers. By Alfred Elwes. New and Revised Edition. (London: Griffith and Farran, 1878.)

Under the Red Ensign. By Thomas Gray. (London: Simpkin, Marshall, and Co., 1878).

THESE are two good books, each in its way. The former is a narrative of the nations which have from the earliest ages had dominion over the sea, comprising a brief history of navigation down to the present time. It is evidently intended for boys and is likely to interest the more thoughtful of them and send them to works which will give a more detailed account of the peoples whose exploits by sea are told, and lead them to take an interest in geographical discovery. The reading is rather miscellaneous and unconnected, and the information sometimes undigested, but as a whole the book is useful and interesting.

Mr. Gray's booklet is one that will prove thoroughly useful to parents intending to send their boys to sea, as well as to the boys themselves. Mr. Gray knows well what he writes about, and the information and advice he gives as to the choice of a sea-life as a calling, how to get a boy launched into it, what kind of ship to choose, how the boy should conduct himself, what books he should read, and a multitude of other points are admirable. We are glad to see that among the books he recommends a large proportion are standard scientific works.

Memoir of the late Alfred Smee, F.R.S., by his Daughter. With a Selection from his Miscellaneous Writings. (London: George Bell and Sons, 1878.)

MR. SMEE was in many respects a remarkable man, and this readable memoir by his daughter will, we doubt not, be acceptable to those who knew him personally or through his works. An Appendix contains about forty papers, letters, pamphlets, &c.; these occupy quite two-thirds of the volume.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

An Intra-Mercurial Planet

WITH reference to the important announcement, by telegram, of the discovery by Mr. Watson of an intra-Mercurial planet during the late eclipse of the sun, it may be worth remarking that the position of θ Cancri agrees very well with that given in the telegram published in NATURE, and that there may be a possibility that the object observed is in reality this star. The position of the suspected planet recorded by Mr. Watson is R.A. 8h. 26m., and N.P.D. 72°; the apparent place of the star, computed from the mean place given in the new Nine-Year Catalogue for 1872, January 1, is, for July 29, R.A. 8h. 24m. 40s., and N.P.D. 71° 29′ 40″. The magnitude of this star is, however, smaller than that given by Mr. Watson, that in the British Association Catalogue being 5½, and that in Argelander's

Uranometria Nova 6. This discrepancy may very easily occur in the hurry of such a sensational observation, as on these occasions the time at the disposal of the observer is so limited.

Royal Observatory, Greenwich, August 3 — G. B. AIRY

Floating Magnets

I HAVE no intention of discussing the beautiful experiments of Prof. A. M. Meyer on floating magnets; but as a privately-expressed opinion of mine has appeared in NATURE, vol. xviii. p. 260, I feel bound to defend it. The mutual repulsion of the vertical floating magnets varies nearly inversely as the fourth power of the distance at great distances, and nearly inversely as the square at small distances. The horizontal attraction of the magnet, held vertically over the water, varies nearly inversely as the fourth power at very great distances. At a certain moderate distance it reaches a maximum, and close to the centre it varies directly as the distance. It is easy to see that variations of the magnetisation of the lengths of the magnets, and of the distance of the large magnet from the surface of the water, may render configurations stable which would, under different conditions, be forms of unstable equilibrium. Prof. Meyer thinks that the configuration . . . can never be stable. It is easy to see that it is a form of equilibrium, and in fact that any given size of hexagon will be brought into equilibrium by placing the large magnet at a suitable distance. It may, therefore, be in equilibrium when the floating magnets are on the circle of maximum attraction of the fixed magnet. But, in this case, the equilibrium is stable; for work would be expended in altering in any way the position of any one of the floating magnets. If this one is carried away from the others they repel it less, and it will be brought back; if it is carried nearer to the others they repel it more, and again it will be brought back.

The nature of equilibrium where there are several degrees of freedom may be illustrated by considering a tract of country upon which water can run. The hollows are positions of stable equilibrium; the summits and passes (saddles) are positions of unstable equilibrium. Then, if any one speaks of the former as more or less stable (as Prof. Meyer does of stable configurations), he may be understood as having reference to the curvature of the hollow, or to its level, or to some vague and mixed characters. It is very easy to understand why the form . ⁘ . should be difficult to produce or maintain. It is because the floating magnets are in this case at much greater distances from the centre than when they assume the form ⁘ Hence, the potential energy of the former configuration is much greater than that of the latter. The reverse is the case with ⁘ and ⁘, and still more so with . . . and ⁘ ⁘, and so with greater numbers of magnets.

C. S. PIERCE

Mons. A. Cavaillé-Coll on Musical Pitch, the French Diapason Normal, Scheibler's Tuning-Forks, &c.

IN the course of my researches on musical pitch, with the view of discovering the source of the discrepancy between Appunn's and Lissajous's measurement of the French diapason normal, I have had the good fortune to enter into correspondence with M. Aristide Cavaillé-Coll, the celebrated Parisian organ-builder, and in his long and obliging answers to my inquiries he has communicated some facts which I have thought it important, with his permission, to lay before the readers of NATURE, as far as possible in his own language.

Scheibler, and the Persistency of the Pitch of Tuning-forks.—M. Cavaillé-Coll had the advantage of personally knowing Heinrich Scheibler, silk manufacturer, of Crefeld, near Düsseldorf, who died November 20, 1837. Scheibler's experiments on tuning, with which I had long been acquainted, are the most important hitherto made; but I had feared that his wonderfully accurate tuning-fork tonometer was irrecoverably lost. I find that M. Cavaillé-Coll is fortunate enough to possess one, and Herr Amels, of Crefeld, another, that is, a series of fifty-six forks, proceeding by degrees of four beats in a second, from A 220 to A 440 double vibrations in a second, which last was adopted by the Stuttgart Conference in 1836 as the best normal pitch. This was chosen by Scheibler as his standard, because it was the mean of the Viennese grand pianos in his day. Of him M. Cavaillé-Coll says:—

"M. Scheibler n'était pas un savant, mais, en s'appuyant sur les expériences faites par Sauveur en 1701 pour la détermination d'un son fixe, il était arrivé par ses patientes recherches à créer, en 1834, un tonomètre différentiel de la plus rigoureuse exactitude et qui n'avait pas été fait avant lui."

Of the exactness with which Scheibler worked M. Cavaillé-Coll gives the following remarkable proof, which is at the same time a proof that tuning-forks will preserve their pitch for at least twenty-eight years; so that there is no reason to suppose that, when properly protected, they will not form a lasting record. This was a point on which I dwelt much in my letter to M. Cavaillé-Coll, because it has been often thought that they might vary considerably. See Zantedeschi (*Sitzb.* Vienna Acad. vol. xxv., year 1857, p. 172), whose conclusions I believe to be erroneously based. M. Cavaillé-Coll says, in his first letter (January 24, 1878):—

"En 1862, j'ai eu l'avantage d'assister aux expériences faites par M. Léon Foucault pour la détermination expérimentale de la vitesse de la lumière. Ce savant expérimentateur, que la mort a enlevé à la science en 1868, se servait, pour mouvoir son miroir tournant, d'un petit tambour mis en mouvement par une soufflerie et un régulateur de pression que je lui avais établis; laquelle turbine devait faire 400 tours à la seconde. Or avec cette vitesse, la turbine faisait entendre un son d'axe dont le nombre de vibrations correspondait au nombre de tours." In a subsequent letter (February 8, 1878) M. Cavaillé-Coll adds:—

"M. Léon Foucault, bien qu'il fit construire ses instruments par les premiers constructeurs, était toujours obligé de les vérifier et de les rectifier lui-même pour arriver à la régularité de marche qu'il avait en vue d'obtenir."

"Pour mesurer la vitesse de la turbine, M. Léon Foucault avait imaginé un moyen nouveau que je vais essayer de décrire. D'abord une pendule de précision, construite par l'habile constructeur Froment, mettait en évidence une roue dentée de 400 dents, laquelle faisait un tour entier par seconde. Ensuite, la turbine était disposée de manière à réfléchir un rayon lumineux du miroir tournant sur les dents de la roue. Or la coincidence des rayons lumineux avec le passage des dents de la roue de la pendule permettait de reconnaître, à l'immobilité apparente des dents de cette roue, que la vitesse de la turbine était alors exactement de 400 tours par seconde." This description is necessary to understand the extreme delicacy of the test of Scheibler's work, which follows. "Un jour que j'assistais à une de ses observations, M. Léon Foucault me dit: 'Si nous avions un diapason exactement accordé de 400 vib. par seconde il devrait se trouver d'accord avec le son d'axe de la turbine? Sans rien dire à M. L. Foucault, je cherchai dans mon tonomètre de Scheibler un diapason de 400 vib., et l'ayant comparé avec le son d'axe de la turbine, je le trouvai si exact que je fus émerveillé de constater que par des moyens différents et à plus d'un quart de siècle de distance ces deux savants expérimentateurs avaient atteint avec la même perfection la détermination d'un son fixe donnant exactement 400 vib. par seconde. Cette circonstance est venue confirmer dans mon opinion que le tonomètre de H. Scheibler pouvait être regardé comme un instrument de la plus haute précision." M. Cavaillé-Coll concludes:—"Dans mon opinion le diapason conserve le même ton à la même température. Il n'y a que l'altération du métal lui-même qui puisse faire changer le ton; mais si l'on prend les soins nécessaires pour préserver les diapasons des influences climatériques, comme le faisait H. Scheibler, on peut être à peu près certain qu'ils conservent le même ton."

Improvements in the Siren, Bellows of Precision, Double-Action Counter.—M. Cavaillé-Coll was also personally acquainted with M. le Baron Cagniard de Latour, and was "initié à ses travaux." He calls him "un des plus savants acousticiens français du siècle présent," and says he is "sans contredit le véritable inventeur de la syrène;" adding, "la date de la création de ce merveilleux instrument, qui se trouve aujourd'hui dans tous les cabinets de physique d'Europe, remonte à l'année 1819;" and he complains that Helmholtz should have mentioned Seebeck's first, even on the score of simplicity of construction, as it was invented so long afterwards.